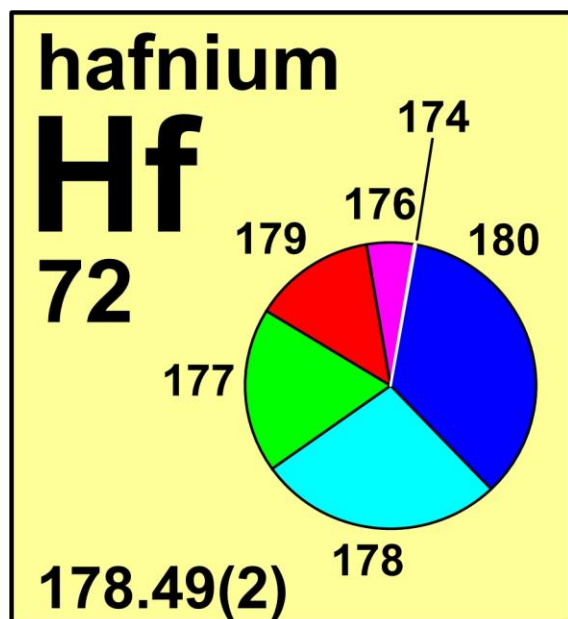





hafnium

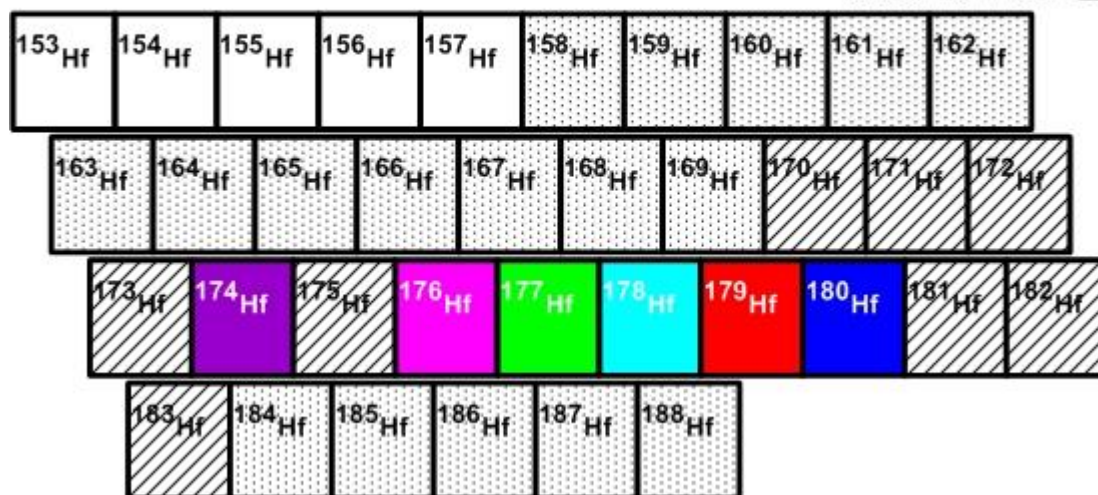


Stable isotope	Atomic mass*	Mole fraction
^{174}Hf	173.940 046	0.0016
^{176}Hf	175.941 4086	0.0526
^{177}Hf	176.943 2207	0.1860
^{178}Hf	177.943 6988	0.2728
^{179}Hf	178.945 8161	0.1362
^{180}Hf	179.946 55	0.3508

* Atomic mass given in unified atomic mass units, u.

Half-life of radioactive isotope

Less than 1 second 
 Between 1 second and 1 hour 
 Greater than 1 hour 



Important applications of stable and/or radioactive isotopes

Isotopes in geochronology

- 1) Some ^{176}Hf is radiogenic, having formed as a product of beta decay of radioactive ^{176}Lu (half-life = 3.73×10^{10} yr).
- 2) Relations between the ^{176}Hf : ^{177}Hf and ^{176}Hf : ^{176}Lu ratios can be used to determine the ages of minerals and rocks. Because of the long half-life, this pair has been used in geochronologic studies documenting some of the oldest rocks in the solar system including Earth.
- 3) In addition, because Hf isotopic compositions of Earth materials evolved differently depending on the relative rates of radiogenic ^{176}Hf production, geologists can use calculated Lu-Hf ages and initial ^{176}Hf : ^{177}Hf isotope ratios, along with other isotopic data from the oldest rocks in Earth, to

infer that differentiated crust must have formed relatively early in the evolution of the Earth (Figure 1), apparently having been present within the first few hundred million years after condensation of the oldest solid matter in the solar system.

- 4) Radioactive ^{182}Hf decays to ^{182}W with half life of 8.9×10^6 a, much less than the age of meteorites and the Earth. Therefore, measurements of Hf and W isotopes in meteorites and terrestrial samples can reveal the former presence of “extinct” ^{182}Hf , providing information about chemical differentiation and evolution of the solar system in the early part of its history between nucleosynthesis and condensation.

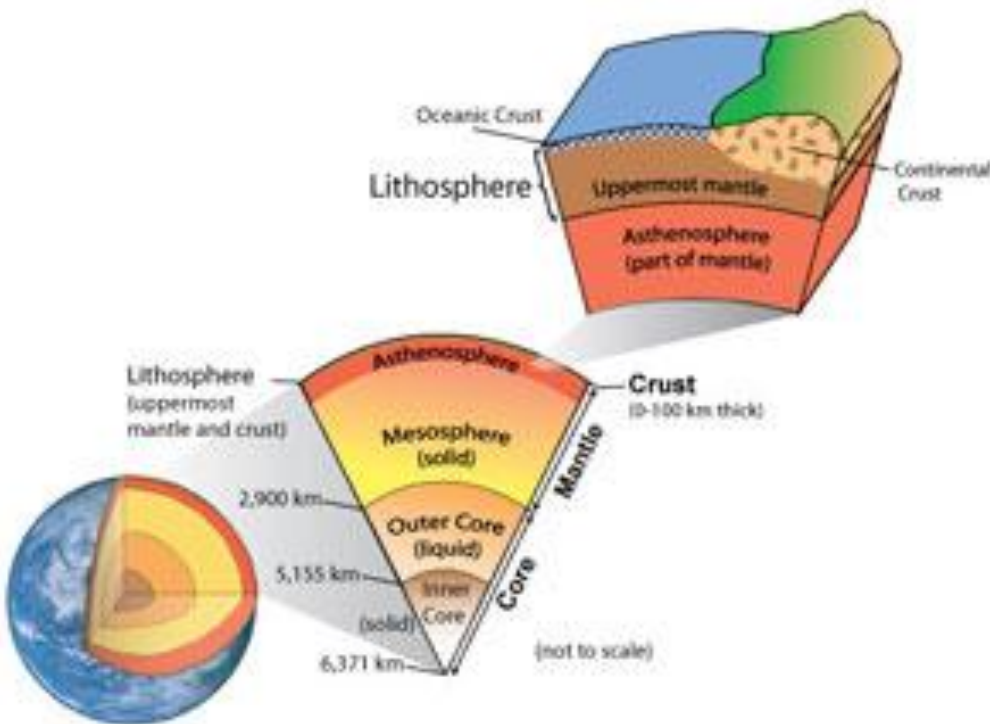


Figure 1: Layers of the Earth, largely caused by gravitational differentiation in early Earth history.